CLAIMS

1.   A smart optical sensor for use in airbag systems having at least one airbag associated with passenger compartments of motor vehicles, the sensor comprising: an array of photo sensitive elements for acquiring images of the passenger compartment, and a circuit for processing the signals corresponding to said images generated by said photo sensitive elements, said processing circuit configured according to a cellular neural network processing architecture of said image signals, said processing circuit adapted to generate, as a function of said image signals, an output signal indicating the deployment modalities of the airbag to which the sensor is associated.

2.   The sensor of claim 1 wherein said array of photo sensitive elements and said processing circuit are comprised in a single integrated component.

3.   The sensor of claim 1 wherein said cellular neural network comprises a plurality of cells each associated with a respective photo sensitive element of said array.

4.   The sensor of claim 3 wherein said cells and respective photo sensitive element are implemented in separate islands in a CMOS technology well.

5.   The sensor of claim 1 wherein said photo sensitive elements comprise a coupling area between a bulk and a CMOS technology well forming the photo sensitive area.

6.   The sensor of claim 1 wherein said processing circuit comprises:

at least one analogue memory for storing image data by photo sensitive elements of said array, and

a control logic for executing real-time image processing sequences in said cellular neural network.

7.   The sensor of claim 6 wherein said processing circuit comprises means for storing configuration parameters for said cellular neural network.

8.   The sensor of claim 7 wherein said configuration parameters are stored in digital form and said processing circuit comprises a digital-analogue converter for converting said parameters in analogue format in view of being supplied to said cellular neural network.

9.   The sensor of claim 1 wherein said processing circuit is configured to carry out at least one of the following operations:

thresholding,

noise reduction by smoothing,

cumulative difference calculating between images or ADI,

contour imaging,

noise reduction by small object deletion,

contour closing,

closed contour filling,

diagonally connected contour imaging,

movement speed detection of an object in said images.

10.   The sensor of claim 1 wherein said processing circuit is configured to implement a combination operation of the processing results obtained in relation to at least two separate images of the passenger compartment.

11.   The sensor of claim 10 wherein said combination operation is a logical product.

12.   The sensor of claim 10 wherein the result of said combination operation identifies said output signal as indicative of the decision whether to deploy the associated airbag or not.

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13.   The sensor of claim 10 wherein the result of said combination operation identifies said output signal as indicative of the control action of the deployment mechanism of the associated airbag.

14.   The sensor of claim 10 wherein at least two of said separate images comprise a substantially static image and a plurality of dynamic images of the passenger compartment.

15.   The sensor of claim 1, comprising memory means for storing said images of the passenger compartment for later playback.

16.   An optical sensor for use in airbag systems having at least one airbag associated with a passenger compartment of a motor vehicle, the sensor comprising:

an array of photosensitive elements configured to acquire images of the passenger compartment; and

a processing circuit coupled to the array of photosensitive elements and configured to receive signals corresponding to the images generated by the photosensitive elements, the processing circuit configured according to a cellular neural network processing architecture configured to generate, as a function of the image signals, at least one output signal indicating deployment modalities of the airbag to which the sensor is associated, the processing circuit comprising:

at least one analog memory configured to store image data corresponding to the images generated by the photosensitive elements; and

a control logic circuit for executing real-time image processing sequences in the cellular neural network.

17. An optical sensor for use in airbag systems having at least one airbag associated with a passenger compartment of a motor vehicle, the sensor comprising:

an array of photosensitive elements configured to acquire images of the passenger compartment; and

a processing circuit coupled to the array of photosensitive elements and configured to receive signals corresponding to the images generated by the photosensitive elements, the processing circuit configured according to a cellular neural network processing architecture configured to generate, as a function of the image signals, at least one output signal indicating deployment modalities of the airbag to which the sensor is associated, the processing circuit comprising:

at least one analog memory configured to store image data corresponding to the images generated by the photosensitive elements;

a control logic circuit for executing real-time image processing sequences in the cellular neural network; and

a circuit configured to store configuration parameters for the cellular neural network in digital form, the processing circuit further comprising a digital-analog converter for converting the parameters into analog format to be received by the cellular neural network.

18. An optical sensor for use in airbag systems having at least one airbag associated with a passenger compartment of a motor vehicle, the sensor comprising:

an array of photosensitive elements configured to acquire images of the passenger compartment of the motor vehicle; and

a processing circuit coupled to the array of photosensitive elements and configured to receive signals generated by the photosensitive elements that correspond to images of the passenger compartment, the processing circuit configured according to a cellular neural network processing architecture adapted to generate, as a function of the image signals generated by the photosensitive elements, at least one output signal indicating deployment modalities of the airbag, the processing circuit configured to carry out at least one of the following operations:

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thresholding,

noise reduction by smoothing,

cumulative difference calculating between images or ADI,

contour imaging,

noise reduction by small object deletion,

contour closing,

closed contour filling,

diagonally connected contour imaging,

movement speed detection of an object in said images.

19.　An optical sensor for use in airbag systems having at least one airbag associated with a passenger compartment of a motor vehicle, the sensor comprising:

an array of photosensitive elements configured to acquire images of the passenger compartment of the motor vehicle; and

a processing circuit coupled to the array of photosensitive elements and configured to receive signals generated by the photosensitive elements that correspond to images of the passenger compartment, the processing circuit configured according to a cellular neural network processing architecture adapted to generate, as a function of the image signals generated by the photosensitive elements, at least one output signal indicating deployment modalities of the airbag, the processing circuit configured to carry out at least one of the following operations:

thresholding,

noise reduction by smoothing,

cumulative difference calculating between images or ADI,

contour imaging,

noise reduction by small object deletion,

contour closing,

closed contour filling,

diagonally connected contour imaging,

movement speed detection of an object in said images;

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the processing circuit further configured to implement a combination operation of the processing results obtained in relation to at least two separate images of the passenger compartment generated by the array of photosensitive elements.

20.   An airbag system for use in a passenger compartment of a motor vehicle, the system comprising:

an airbag;

an array of photosensitive elements configured to be mounted in the passenger compartment and to acquire images of the passenger compartment and to generate therefrom signals corresponding to the images of the passenger compartment; and

a processing circuit coupled to the array of photosensitive elements, the processing circuit comprising a cellular neural network processing architecture configured to receive the image signals from the array of photosensitive elements and to generate therefrom at least one output signal indicating deployment modalities of the airbag; and

a memory circuit for storing images of the passenger compartment generated by the array of photosensitive elements for later playback.